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ABSTRACT

Adoption of a value analysis program is proposed to aid colleges in identifying and implementing educationally sound labor-saving devices and procedures, enabling them to meet more students' needs at less cost with no quality reduction and a minimum of staff resistance. Value analysis is defined as a method for studying how well a product does what it is supposed to do compared to how much it costs to manufacture, and for evaluating how to better perform a necessary function at a low cost consistent with the quality level desired. The relevance of value analysis to education is explored, and its procedures are outlined in terms of information gathering (What is it? What does it cost and do?), speculation, analysis, execution, and reporting phases. Pitfalls to avoid are cited. Value analysis is then compared to the traditional recommendation process--the committee. It is felt that a value analysis team is prepared by virtue of expertise, interest, and experience while committee members are unprepared for the task at hand. Berchin's study for the League for Innovation is cited as support for adopting value analysis programs. Data on direct costs for conventional modes vs. group, individual, and audictutorial instruction from Berchin's investigations are appended. (TR)

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VALUE ANALYSIS:

A TOOL FOR COMMUNITY COLLEGES

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INTRODUCTION

Since the early 1960's, education has been facing a growing financial crisis. Libraries are full of studies, reports and analytical texts written on the subject. While the volume of such literature appears to have decreased, the problem most certainly has not. Rather, it has been simmering slowly on the back burner while the taxpayer who supports public education has been rising to the boiling point.

Both external and internal factors have contributed to the fiscal problems confronting education and to its fall from public favor. Inflation, rapid growth in enrollment, public dissatisfaction with both the rising cost and what is viewed as declining performance in education, and an unsettling period of student unrest are among the external contributors. Educators, themselves, are blamed for the internal factors: escalating tenure-based salary schedules, which now account for up to 90% of a district's costs (San Diego Union, B-5); fringe benefits "which are tucked away in a neat littl-noticed corner of the budget labeled 'fixed charges'" (L.A. Times, A-29); the addition of numerous costly non-traditional programs and services; and, collective bargaining, with its demands for higher salaries, lighter workloads and increased hiring (Lombardi, pp 10-11).

Typical of education's many critics, James S. Dwight, then heading Governor Reagan's six-part study into the state of the art, is quoted as saying, "Educators provide probably the worst example in the government area of slipshod money-husbandry" (L.A. Times, A-29). No one likes to be accused of irresponsibility in any area, particularly not in the area of fiscal management; and, there are arguments on both sides. Nevertheless, if the Jarvis-Gann initiative, the so-called Property Tax Ammendment, is passed by the electorate in June, 1978, the year 1978-1979 may see many public California schools and colleges either close their doors (San Marcos Courier, p. 1) or be forced to retrench to a degree never before envisioned in the history of California education.

Added to a bleak future assured under the Jarvis-Gann ammendment, community colleges are presently experiencing enrollment stabilization *coupled with* a peculiar shift from a dominantly full-time student population to a dominantly part-time one (California Community Colleges, p.9). Enrollment stabilization alone has been viewed by many college administrators as a welcome relief after the recent extended period of runaway growth, as a time in which to get their house in order and to work to restore public confidence in education. The drop in WSCH's associated with the shift to part-time enrollment, however, means a further dramatic cut in actual income, in state revenues. The situation is now critical.

In some ways, educators have been their own worst enemy. Lombardi sums it up this way: (p. 9)

> "Education in and out of the classroom is a labor-intensive enterprise in contrast to capital-intensive industries. As now being conducted, it does not lend itself to the introduction of labor-saving devices that achieve greater productivity to offset increasing costs."

Today, he might well alter that statement to say, " . . to offset drastically reduced revenues!"

Lombardi does not imply that education could not, or should not, make use of the techniques of industry. He favors such use. He notes, however, that the major deterrent to the employment of labor-saving devices is faculty resistence enforced by faculty organizations antagonistic to them (1973a, p. 100).

There are many aspects of the financial woes of the California community colleges which could form the core of a paper. I address myself to only one: the possible reduction of per capita cost of instructional programs, with no reduction in quality, through the employment of a known, successful industrial management tool, *value analysis*. I do not suggest that employing this tool will provide instant relief for troubled colleges. It has taken two decades to get into this mess and it will take some time to get out. It is necessary, however, for education to stop equating itself to the operation of a subsidized public agency and to begin thinking like a profit-making corporation (Lombardi, 1973a, pp 72-73) The community colleges can lead the way.

My hypothesis is that a well-conceived, properly planned and operated *value analysis* program can aid in identifying and implementing educationally sound labor-saving devices and procedures which will enable colleges to meet the needs of more students at less cost with no reduction in quality--and can accomplish this goal with a minimum of staff resistance. I stress the words "educationally sound" and "quality." I concur with Arthur Cohen's not so heretical criticism that community colleges have warped innovative practices by adopting them for the wrong reasons, using them in the wrong way and forcing them into an archaic system which mitigates their effectiveness (pp 88-98). I agree that "if directed change is to occur, the (community) college must stop climbing on every innovative bandwagon that comes along and begin to study education itself" (p. 93). I see this to be one of the important objectives of a *value analysis* program.

In the succeeding sections of this paper, I shall define *value analysis*, investigate its relevance to education, outline its procedures, compare it to the traditional recommending process, the committee, and cite examples of the kind of labor-saving, cost reducing, quality maintaining changes that could be expected to emerge for instruction from a *value analysis* program.

VALUE ANALYSIS: A TOOL OF INDUSTRY

As applied to business and industry, value analysis is: (Fram, p. 1, emphasis added)

> " . . an analytical approach for examining the relationship between the performance, or satisfaction provided by a product or service and the cost of making the *essential* performance or satisfaction available."

Put in another way, value analysis is a procedure for studying how well a product does what it is supposed to do compared with how much it costs to manufacture that particular product or any other items designed to do the same thing.

Value analysis differs from normal, everyday cost reduction methods. A cost reduction decision might be to buy a cheaper brand of paper, turn off the lights fifteen minutes earlier or buy typewriter correction fluid in larger quantities to realize savings. A value analysis report, on the other hand, might suggest that:

Correction fluid should be phased out in favor of typewriters with automatic correcting devices; or,

The company should discontinue the manufacture of Product "A" in favor of a totally new one, Product "B" which will more economically provide all the *essential* functions of Product "A".

By whatever name value analysis is known--and there are several--the important word is *value*. Fram notes that none of the definitions of *value* provided by the dictionary and none applied to the products of specific industries will work for the purpose of value analysis. He provides this definition of *value:* (p. 1)

> "Value (in a value analysis program) is the relative cost of providing a necessary function or service at the desired time and place with the essential quality."

Value, then, is a relative matter and, by definition, is *not* an inherent characteristic of a product. It is concerned with *necessary* functions and services; it involves a *time and location* factor; and, it considers the quality of a product in terms of the *customer's needs and expectations* (Fram, p. 1).

Value analysis deals with the question of how to perform a necessary function at the lowest cost consistent with the level of quality desired. It involves looking at a product in a new way, of redesigning it, then looking at it again--and again. It is concerned with identifying *unnecessary costs,* costs that do not add essentially to the reliability or quality of a product. It is a never-ending process which benefits both the company and the customer (pp 2-3).

Unnecessary costs are normal ingredients in any business or industry. They appear and are tolerated for any or all of the following reasons:(p. 4)

Incomplete data: No one person or small group of people have time to assess the flood of information available.

Habit: Under pressure we fall back on habit in making simple decisions.

Negative attitudes: We frequently reject new ideas through fear of failure.

Lack of advice: Too often, seeking advice is considered a sign of weakness. Invariably, not seeking advice leads to unnecessary costs.

Comfortable procedures: Every organization operates under numerous procedures which probably cost too much but with which everyone has lived "comfortably" for a long time. If no one takes the time or trouble to bother with them, they go on year after year adding to the unnecessary costs.

VALUE ANALYSIS: ITS APPLICATION TO EDUCATION

If value analysis *is* a valid tool for education, its definition and principal tenets should be relevant when rewritten in educational jargonese. Let us see if they are. [Rewritten passages are bracketed]

Value analysis is:

" . . an analytical approach for examining the relationship between the performance, or satisfaction provided by a product or service and the cost of making the essential performance or satisfaction available."

[. . an analytical approach for examining the relationship between the goals and objectives of a course, program or service and the cost of making the essential goals and objectives available.]

Little has been changed, merely the substitution of "goals and objectives" for "performance, or satisfaction" and "course, program or service" for "product or service." At this point there appears to be relevance.

Moving on to Mr. Fram's definition of *value*. Again, only a simple substitution of terms is required.

"Value is the relative cost of providing a necessary function or service at the desired time and place with the essential quality."

[Value is the relative cost of providing the instructional programs and services required by students of the district at the time and place they find acceptable and in the manner best suited to their immediate and long-range needs.]

Value still is a relative matter; it still is concerned with necessary functions and services; it still involves a time and location factor; and, it considers the quality of the product in terms of the customer's needs and expectations.

Nothing would be gained by altering the cited examples of a cost reduction decision. Paper, lights and typewriter correction fluid have as much relevance to education as to industry, and decisions of this kind are made every day by college business managers. Let us compare the two

examples of an industrial value analysis report with an example in education. The industrial examples read as follows:

> "Correction fluid should be phased out in favor of typewriters with automatic correcting devices."
>
> "The company should discontinue the manufacture of Product "A" in favor of a totally new one, Product "B", which will more economically provide all the essential functions of Product "A".

An unrefined educational value analysis report might read:

> /It is suggested that two undersubscribed conventional sections art history and one undersubscribed conventional section of art appreciation be discontinued in favor of one new large group section utilizing several non-traditional instructional techniques./

In its final, refined form, the report would probably recommend when and where the new course would be conducted, how large it would be, what personnel would be required, what its future enrollment would be and precisely what non-traditional instructional techniques would be utilized.

It appears clear that value analysis is applicable to and consistent with the recognized goals, objectives and functions of the community college.

VALUE ANALYSIS: HOW DOES IT WORK?(1)

Human beings tend to resist change simply because it disturbs the status quo. A value analysis proposal, however, requires that something *be* changed in order to produce improvement. To be effective, therefore, a value analysis proposal must be supported fully by the Board and the administration of the college and accepted and implemented by members of departments and divisions affected by the recommended change. To accomplish this end, value analysis *must be a group activity;* and, the value team *must be selected carefully* to include supportive individuals, instructors, students and classified personnel, representative of those who will be required to participate in the change.

If change is to involve hardware and software, suppliers should be members of the team. Not only must they have adequate knowledge of the use

(1) The basic reference for this section is Pram, chapters 4 and 5. Care has been taken to translate the full and accurate meaning of the author's explanation of a value analysis program from its industrial application to application in a community college.

to which their products may be put before making intelligent recommendations, but they know of new products coming on the scene and their input from outside looking in will be an asset in any planning session.

The five phases of a value analysis program must be planned carefully and implemented with serious consideration as to their importance. They are outlined as follows:

Information Phase

Three questions are asked about the course, program of service subject to a value analysis study: (p. 7)

1. *What is it?* A complete definition--course title, course description, units, hours, prerequisites, time and location of instruction, transferability and categorical designation. Similar detail is required for a program or a service.

2. *What does it cost?* An accurate cost breakdown or reliable estimate.

3. *What does it do?* A clear, accurate definition of the primary and secondary goals and objectives of the course, program or service. This is *the basic element* of the value analysis technique. There can be no room for misunderstanding.

Care must be taken in responding to the third question that the answer is not too restricting. For instance, at the beginning of the session, the primary goal of our art history course might be seen as, "To fulfill a lower-division requirement for transferring art majors." However, after consideration of the fact that not all art history students are art majors, not all transfer, some enroll to satisfy a general education requirement for the A.A. Degree, some to prepare for a trip to Europe, and some to satisfy a long-time interest in the subject, the primary goal might better be defined as, "To satisfy the various academic and personal needs of both the traditional and the non-traditional student in the area of art history." The way is now open to think creatively about constructive change.

In another example, Financial Aids, the primary goal might be stated, "To make loans and grants available to needy students." Less limiting, however, is this possibility: "To make it financially possible for students to attend college." Seen in this light, even the title might well be changed, and consideration might be given in the next phase to expanding the service, combining it with another, or creating a totally *new* one.

Speculation Phase

This is the creative thinking phase of value analysis. Here the question is asked, "What else will do the job?" Fram suggests that the procedure be equated to the never-ending patterns of a kaleidoscope. A value team must arrange and rearrange its knowledge to create new ideas.

In the problem-solving sessions of the speculation phase, free-wheeling must be welcomed. The wilder the ideas the better. None should be belittled. Nothing kills creativity faster than a negative response. The team must operate on the basis that there are no bad ideas, only good ones and better ones. The technique of "Blast, create and refine" should be employed: blast through regimented traditional ways of thinking; find new ideas; then, refine raw ideas by using sound judgement to obtain the desired goals and objectives and the essential quality (pp 9-11). Combine! Substitute! Reverse! Rearrange! Make it bigger! Make it smaller! Use imagination! Brainstorm!

Analysis Phase

This is the time to be critical. Two questions are asked, "Will it work?" and "How much will it cost?"

Experience has shown that the team which has come up with the list of creative ideas should now be replaced by one which can view the proposals objectively and has the authority to implement change. At this point, then, department personnel might be replaced by division deans.

The first step is to eliminate ideas which obviously don't apply. Emphsis is to be placed on the distinctive characteristics of the course, program or service which are considered important by the college. As the list is pared down, reliable cost estimates need to be made.

It is important to prove beyond a shadow of a doubt that the proposal recommended for implementation in this phase will indeed provide *better value* than the course, program or service it will replace. If in doubt, DESIGN AND BUILD A MODEL!

Execution Phase

This is the time in the value analysis procedure for selling naturally resistant people on making the kinds of change called for in the study. We can all recall cases where days, months of preparation have gone into a

new idea, only to have it die on the vine for lack of approval. Fram cites a classic case involving a committee report on consideration of the telephone as an investment. After detailing six logical reasons why the telephone will never sell, the report concludes: (pp 11-12)

> " . . this committee feels it must advise against any investment whatever in Mr. Bell's scheme. We do not doubt it will find a few uses in special circumstances, such as between the bridge of a ship and the engine rooms, but any development of the kind and scale which Mr. Bell so fondly imagines is utterly out of the question."

In preparing the team's recommendations to top-level administrators and the Board, the following practical suggestions should be observed:

1. Concentrate on specifics.
2. Spend district money as prudently as you would your own.
3. Consider ease of implementation: don't upset the applecart completely.
4. Seek expert advice on highly technical features.
5. Avoid mental roadblocks, negative attitudes and habits of thought which impede communication.
6. Remember, the whole process has been a waste of time and money unless good ideas are implemented.

Reporting Phase

Assuming that approval has been obtained for full-scale implementation, this phase deals with communicating the decision to the entire college. Careful planning is required to ensure acceptance. The report must include:

1. A complete explanation of the existing mode, procedure, organization, technique, etc., including a detailed cost breakdown.
2. A concise definition of the basic goals and objectives of the course, program or service proposed to be changed.
3. A detailed explanation of the alternate proposal.
4. An analysis of the features of the alternate proposal which make it a better *value*.
5. An estimate of the dollar costs of the alternate proposal and the savings expected to be realized.
6. (A 1978 addition to Mr. Fram's list) A graphic illustration of what these expected savings, combined with others anticipated through value analysis studies, mean in terms of restoring salaries to their normal level!

In this phase, the administration and the Board play a vital role. Having decided to initiate a value analysis program, they must communicate their support of the goals of the program as well as their conviction that no criticism is intended or implied of anyone associated with the original course, program or service. If this policy is not followed in all circumstances at all times, value analysis will surely fail.

Pitfalls to Avoid

To minimize rejection and maximize acceptance, the following suggestions should be observed:

1. Start small. Learn to walk before you run.
2. Don't assign people to a value analysis team who don't believe in it.
3. Avoid making critical statements, such as, "Why didn't we do it this way in the first place?"
4. Don't propose changes that have not been sufficiently developed.
5. Remember, no decision is set in cement. Value analysis probably will be applied to the problem again and again.
6. If people don't like the words "value" or "value analysis," try other terminology.

VALUE ANALYSIS VS. THE COMMITTEE

The question may well be asked, "What is so different about a value analysis program from the way we've always done things around here--with committees?" I see a very great difference.

1. By its very nature, a committee is not a "team." All members of a committee may not have a strong desire to serve and many may not chose to participate actively, yet a quorum is required to do business.
2. Much time is lost in committee meetings 'educating' members on the issues. The members of a value analysis team are already knowledgeable.
3. Creativity is not a goal of most committees. It is THE goal of a value analysis team.
4. Few committee members study the agenda before a meeting. A properly selected value analysis team member is prepared by virtue of interest, expertise and experience.
5. The time and energy devoted to a single issue by a committe is minimal. A value analysis team devotes its full time to a single issue.

It follows that the character and quality of a committee recommendation will fall short of the character and quality of a value analysis team recommendation. Logic would suggest, therefore, that a team composed of interested, knowledgeable educators, support personnel and students, all concerned with the cost and quality of instruction, should function more effectively than a conventional committee in the task of identifying "labor-saving devices and procedures" which will "meet the needs of more students at less cost with no reduction in quality." In addition, because of its respectful, "freewheeling" team approach, it will be more innovative.

VALUE ANALYSIS: CAN DOLLARS BE SAVED AND QUALITY MAINTAINED?

To prove my hypothesis, I have detailed the "properly planned and operated" value analysis program organized for the purpose of recommending innovative cost-reducing changes in education and have outlined procedures for minimizing staff resistence. Left to be done is the identification of innovative "devices and procedures" representative of those which reasonably might be recommended by a value analysis team for the purpose of meeting the needs of more students at a desired level of quality and at less cost.

In his study for the League for Innovation in Community Colleges, Berchin details three procedures with which we are familiar, three non-conventional modes of instruction, all accepted as educationally sound and all potentially "labor-saving" in that they utilize professional personnel, paraprofessionals and hardware more effectively than do conventional modes. They are the large group mode, the individualized programmed mode and the audiotutorial mode (pp 19-106). Summarizing, Berchin observes that courses organized under any of these modes "are generally less costly on a per-pupil basis than conventionally organized courses" (p. 5). He also notes that subjective data indicate that courses taught under any of these non-conventional modes of instruction "generally produce more effective instruction than their matching conventionally organized courses."

Berchin's comparison of the cost per student of fifteen large group courses and their matching conventional courses (see Appendix A) shows that eleven (73.3%) of the large group courses were actually less costly per

capita than their conventional counterparts. Projected to maximum enrollments, the number of less-costly large group courses increased to thirteen (86.6%) (Berchin, pp 108-147). The enrollment, itself, in the large group courses had a potential growth of almost 50% at no increase in cost, whereas the conventional courses could increase less than 4%. It is notable that projected to optimum enrollment, the two conventional courses which cost less than their matching large group courses would each require an additional section with an additional instructor to meet the needs of the equivalent number of students served by the large group courses. The actual cost would double.

In the comparison of twenty individualized programmed courses matched with conventional courses (see Appendix B), fourteen (70%) of the non-conventional courses actually cost less on a per capita basis than the conventional courses. Projected to optimum enrollment, twelve non-conventional courses of nineteen reporting pairs (58.3%) totaled equal or less cost per student (Berchin, pp 150-194).

In education we are dealing with people, not machines. Variables play an important role in a study such as this. At least two variables are noteworthy in the group above. For one, the instructor of an individualized programmed course in accounting, dissatisfied with the large group character of his course, recommended a reduction from an actual enrollment of 144 to an optimum of 40. The result was a tabulated increase in per capita cost from $28.76 to $103.53! Secondly, the per capita cost of a conventional course in mathematics was substantially lower than that of its matched individualized programmed course by virtue of the fact that the conventional course was taught as an hourly overload, not prorated contract.

In the study of the fifteen matched pairs of audiotutorial and conventional courses (see Appendix C), nine (60%) of the audiotutorial courses actually cost less per capita. The number increased to eleven (73.3%) when projected to optimum enrollment.

The youthfulness of the non-conventional courses in this study is evident. Of the 56 non-conventional courses, only 18 (32%) had reached or exceeded their optimum enrollments. Of the 49 conventional courses reported, 31 (63%) had reached or exceeded their optimum enrollments. If the traditionally established enrollments for conventional courses were observed, it

could be anticipated that the conventional courses would require many more new certificated instructors for the next budget year than would be required for the non-conventionally organized courses. Even more important to cost-reduction, experience has shown that, rather than requiring additional certificated personnel, many non-traditionally organized courses require only more paraprofessional personnel to handle increases in enrollment.

Other instructional procedures which have been implemented on most community college campuses include modular scheduling, team teaching and closed- and open-circuit television instruction. Specific devices which can be employed in any of these procedures to save labor and cut costs include machine-graded objective testing; the printed syllabus; audio- and video-taped and stored lectures for use in a learning center; programmed materials; peer proctors and peer tutors; and, of course, paraprofessionals. A creative value analysis team could "arrange and rearrange" these and other procedures and devices innovatively "to meet the needs of more students" in innumerable ways--and could, without doubt come up with suggestions for new "devices" not yet invented. The suggestion is exciting.

In the interest of cost reduction, I must observe that peer proctors and peer tutors, in specific instructional disciplines, can be obtained COST-FREE. In fact, they can be revenue producing. For units of credit, not dollars, advanced "Special Projects" or "Honors" students may be selected and trained to function as 'junior' paraprofessionals. In my experience, these students are enthusiastic adjuncts to instruction, performing services to students which can not be equaled by professional staff, while earning academic credit and gaining in-depth knowledge and experience in a subject for which they have an expressed interest.

While objective data collected by Berchin indicated that "no consistent pattern exists" between the effectiveness of non-conventional courses over conventional courses, instructors interviewed consistently reported that large group instruction "is at least as effective as the conventional mode," and that students are provided with "benefits not available under the conventional approach" (p. 24), that individualized programmed courses "are definitely superior" to those conducted conventionally (p. 50); and that students in audiotutorial courses are "better trained" and are "enjoying

learning" more than students in conventional classes. These instructors appeared certain that, given time, they would improve their instructional materials to such a degree as to prove the greater effectivity of the audio-tutorial mode (p. 82).

CONCLUSIONS AND RECOMMENDATIONS

> "Changing the pattern of classroom organization or the instructional mode can reduce per-pupil costs and increase learning effectiveness." (Berchin, p. 4)
>
> "Community colleges should offer courses using various modes of instruction (which are) systematically designed to attempt to reduce costs and provide more effective instruction." (Berchin, p. 6)

These two statements--one a conclusion, the other a recommendation--sum up the thesis of this paper. The question may now be asked, is it a realistic thesis? What are the chances for constructive, cost-reducing change, of the nature and scale suggested in this paper, happening in the near future?

On the face of it, the factors working against such a goal appear to outweigh those which favor it. The archaic laws under which community colleges in California operate, particularly the "50 Percent Law", the law mandating the 175-day year, and aspects of the law tying the dispersement of state revenues to colleges to ADA, are deterrents to efforts to implement educationally sound, innovative, cost-reducing programs and services.

Minimal credentialing requirements and inadequate and antiquated graduate training programs for community college instructors promote limited understanding of the role of the colleges in the plan for higher education and even less of effective and innovative instructional techniques. The self-serving attitude of faculty and their collective bargaining agents actually promotes costly instructional practices, regardless of merit, over cost-reducing change. And, as one educator phrased it, "In times of tight budgets, you don't get innovation. You just do what you have to do to survive" (Chronical of Higher Education, p.2)

On the bright side, we all know the creative, inventive instructor, who designs and implements innovative cost-saving devices and procedures almost as a way of life, and the far-sighted progressive administrator who goes to bat for constructive change. They do exist. Progress can be made if attitudes and regulations can be changed.

The threat of Jarvis-Gann *could* be a blessing in disguise. The retrenchment it would require of community colleges, should it become law, *could* cause a major revolution in community college education. It could cause colleges to take a long, hard look, not only at programs and services which might be curtailed or eliminated, but also at evaluation and in-service training procedures, and to make much-needed demands for instructional improvement. It could band colleges together to force constructive legislative change. It could shake the grip of self-serving collective bargaining interests. It could, in fact, reverse the mad rush towards fiscal insolvency and start a new trend towards fiscal responsibility. And, properly planned and organized value analysis programs could be one tool by which such a revolution might come about.

Cohen states that, for directed chage to occur, the colleges must begin to study education itself. Lombardi urges education to begin to think like a profit-making corporation. Fram provides a proven industrial tool with which to make profit-making change. And, Berchin provides proof that innovative change can provide quality instruction at less cost.

I recommend that we get started.

APPENDIX A
COMPARISON OF DIRECT INSTRUCTIONAL COSTS
LARGE GROUP/CONVENTIONAL MODES

Course	Total Cost	(1) Staff	Cost Per Student Large Group		Total Cost	(1) Staff	Cost Per Student Conventional	
			Actual	Optimum			Actual	Optimum
Elem. Algebra	$ 3,758	2+1	(77) $48.81*	(70) $53.69 *	$ 1,408	1	(35) $40.23	(35) $40.23
Int. Algebra	1,549	1	(59) 26.25	(115) 13.47	1,549	1	(45) 34.42	(45) 34.42
Anthropology	8,060	1+	(265) 30.41	(300) 26.87	8,625	2+1	(185) 46.64	(200) 43.14
Biology	5,895	1+1	(236) 24.98	(675) 8.73	1 ,548	4+1	(226) 68.80	(240) 64.78
Data Process.	2,661	2 sec.	(125) 21.29	(240) 11.09	,250	3 sec.	(123) 26.42	(120) 27.08
English (Remed.	8,166	2 sec. +1	(364) 22.43	(364) 22.43	25,670	9 sec. +1	(519) 49.46	(510) 50.33
English Comp.	5,100	3-team	(68) 75.00*	(120) 42.50	1,338	1	(26) 51.46	(28) 47.79
Economics	8,731	1+TV +1	(152) 57.44*	(200) 43.65	7,191	1	(131) 54.89	(140) 51.36
History	,527	1+1	(281) 30.35	(450) 18.95	1,675	1+1	(46) 36.39	(50) 33.48
Home Economics	1,330	1+1	(152) 8.75	(200) 6.65	2,501	2+1	(98) 25.52	(100) 25.01
Humanities/ Philosophy	2,700	3	(89) 30.34 *	(100) 27.00 *	883	1	(43) 20.53	(45) 19.64
Music	587	1 hrly +1	(96) 6.11	(200) 2.93	5,971	4	(191) 31.26	(240) 24.88
Psychology	82,891	19+3	(2212) 37.47	(2000) 41.40	-----	Not	Available	
Social Science	3,667	1+2	(201) 18.24	(220) 16.67	1,151	1	(40) 28.77	(45) 25.58
Sociology 211	11,933	1+2	(270) 44.20	(270) 44.20	6,419	1	(109) 58.89	(108) 59.44
Sociology 101	6,320	1	(257) 24.59	(300) 21.07	16,245	3	(444) 36.59	(440) 36.92

(1) The first number indicates hourly or prorated contract certificated staff. The second number indicates paraprofessional staff.

* Indicates cost greater than matching conventional course.

APPENDIX B
COMPARISON OF DIRECT INSTRUCTIONAL COSTS
INDIVIDUALIZED PROGRAMMED/CONVENTIONAL

Course	Total Cost	(1) Staff	Cost Per Student Individualised Programmed		Total Cost	(1) Staff	Cost Per Student Conventional	
			Actual	Optimum			Actual	Optimum
Accounting	$ 4,141	1	(144)$ 28.76	(40) $103.53*	$ 3,442	1	(90)$ 38.24	(90) $38.24
Auto Electron. Repair	5,840	3	(64) 91.25	(75) 77.87	3,853	2	(38) 101.39	(40) 96.32
Data Process.	2,191	1	(24) 91.29	(40) 54.77	3,720	1	(30) 124.00	(50) 74.40
Dev. Math & Elem. Algebra	19,685	5+4	(626) 31.45	(800) 24.61	1,856	1+1	(30) 61.87	(25) 74.24
Dictation-Transcription	600	1	(5) 120.00	(15) 40.00	-----	Not	Available	
Economics	1,004	1	(24) 41.83	(85) 11.81	1,004	1	(22) 45.64	(44) 22.82
Elec. Repair	6,458	1+2	(60) 107.63	(125) 51.66	5,447	1	(30) 181.57	(30) 181.57
English 1	4,545	1	(57) 79.74*	(100) 45.45	4,370	1	(84) 52.02	(70) 62.43
English 2B	6,144	1+1	(59) 104.88*	(50) 122.88*	3,950	2 sec.	(81) 48.77	(50) 79.00
English A	6,127	1+1	(118) 51.92	(373) 16.43	4,827	1	(90) 53.63	(120) 40.22
English X	20,902	11 sec. 6+3	(512) 40.82	(560) 37.32	10,019	4	(132) 75.90	(210) 47.71
Gen. Physics	1,433	1+1	(42) 34.12	(25) 57.32*	1,416	1+1	(29) 48.83	(30) 47.20
Graphic Arts	6,827	2 sec. 1+2	(70) 97.53	(60) 113.78	3,644	1+1	(35) 104.11	(15) 242.93
Keypunch and Data Recording	15,297	1+3	(134) 114..6	(225) 67.99	9,912	4 sec. 1+1	(63) 157.33	(60) 165.20
Math 30 & 31	12,017	2+1	(150) 80.11*	(150) 80.12*	3,903	2	(72) 54.21	(67) 58.25
Mathematics 117	3,604	1	(83) 44.51*	(360) 10.26*	699	1	(77) 9.08	(70) 9.99
Phys. Sci. 121	1,323	1+1	(48) 27.56	(50) 26.46	1,125	1	(20) 56.25	(22) 51.14
Phys. Sci. 1	1,817	2+2	(70) 25.96	(160) 11.36	2,138	2+2	(15) 142.53	(?) N.A.
Poli. Sci. 101	2,003	1	(34) 58.91	(35) 57.23	1,997	1	(33) 60.52	(35) 57.06
Psychology 1	2,770	1+1	(33) 83.94*	(30) 92.33*	4,896	3 sec. 1	(102) 48.00	(135) 36.27
Psychology 101	5,773	1+1	(190) 30.38*	(200) 28.86*	18,367	6 sec. 6+2	(637) 28.83	(720) 25.51

(1) The first number indicates hourly or prorated contract certificated staff. The second number indicates paraprofessional staff.

* Indicates cost greater than matching conventional course.

APPENDIX C
COMPARISON OF DIRECT INSTRUCTIONAL COSTS AUDIOTUTORIAL/CONVENTIONAL MODES

Course	Total Cost	Staff	Cost Per student Audiotutorial				Total Cost	Staff	Cost Per Student Conventional			
			Actual		Optimum				Actual		Optimum	
Int. Algebra	$ 1,123	1+1	(52)	$ 21.60	(70)	$ 16.04	$ 1,031	1+1	(24)	$ 42.96	(30)	$ 34.37
Anat. & Physio.	6,191	2+1	(124)	49.93*	(187)	33.11*	5,221	3	(178)	29.33	(187)	27.92
Intro. Antro.	1,878	1	(120)	15.65	(400)	4.69	3,206	1	(160)	20.04	(140)	22.90
Bio. Concepts	5,852	1+1	(56)	104.50*	(250)	23.41	3,060	1	(56)	54.64	(56)	54.64
Biology 1	10,749	2+1	(140)	76.78 *	(140)	76.78*	16,476	4+3	(330)	49.93	(350)	47.07
Biology 1A	19,815	2+2	(106)	186.93 *	(180)	110.08	8,752	1	(55)	159.13	(60)	145.87
Biology II	26,766	6+1	(475)	56.35	(600)	44.61	-----	Not	Available			
Biology 112	3,678	1+2	(45)	81.73	(100)	36.78	-----	Not	Available			
Biology 115/101	19,703	3+1	(477)	41.31	(900)	21.89	6,764	2+1	(66)	104.48	(150)	45.09
Chemistry 51	4,316	1+1	(38)	113.58	(160)	26.97	3,948	1+1	(31)	127.35	(92)	42.91
Gen. Col. Chem.	16,324	2+1	(214)	76.28	(250)	65.30	8,062	1+1	(105)	76.78	(120)	67.18
Economics	3,150	1	(68)	46.32	(55)	57.27	-----	Not	Available			
Electronics	901	2	(9)	100.11	(20)	45.05	-----	Not	Available			
English A/B	10,081	3+1	(608)	16.58	(608)	16.58	685	1+1	(23)	29.83	(30)	22.87
Humanities	8,742	1+2	(211)	41.43*	(250)	34.97*	7,520	5 sec. 1	(246)	30.57	(350)	21.49
Mathematics	5,311	3+1	(75)	70.81*	(150)	35.41	7,621	3	(141)	54.12	(105	72.68
Nursing	61,399	2	(202)	303.96	(210)	292.38	21,066	3	(62)	339.77	(60)	351.10
Psychology	4,970	1	(300)	16.57	(300)	16.57*	3,525	1+1	(194)	18.17	(240)	14.69
Biology 115	13,173	1+1	(319)	41.29	(400)	32.93	6,052	1	(131)	46.20	(150)	40.35

(1) The first number indicates hourly or prorated contract certificated staff. The second number indicates paraprofessional staff.

* Indicates cost greater than matching conventional course.

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